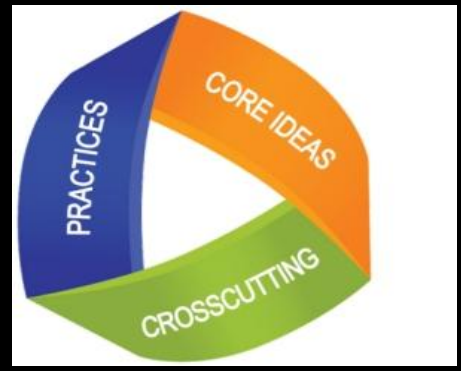
Next Generation Science Standards

NEXT GENERATION SCIENCE STANDARDS (NGSS)

K–12 science standards were developed through a collaborative state led effort

NGSS Focus on a Three Dimensional Learning Model



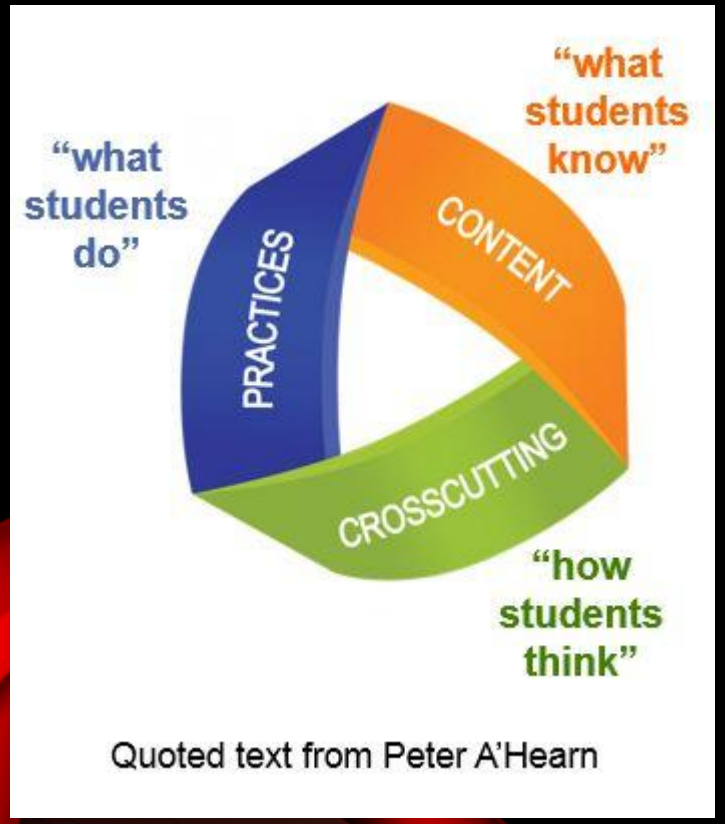
All K–12 students should master these concepts in order for success in college & career.

COHERENT LEARNING PROGRESSIONS

- Engagement in deeper learning of content.
- Builds on knowledge & skills developed at each grade level.
- Allows for revisiting concepts to deepen understanding.

NGSS allows the learner to apply learning in context.

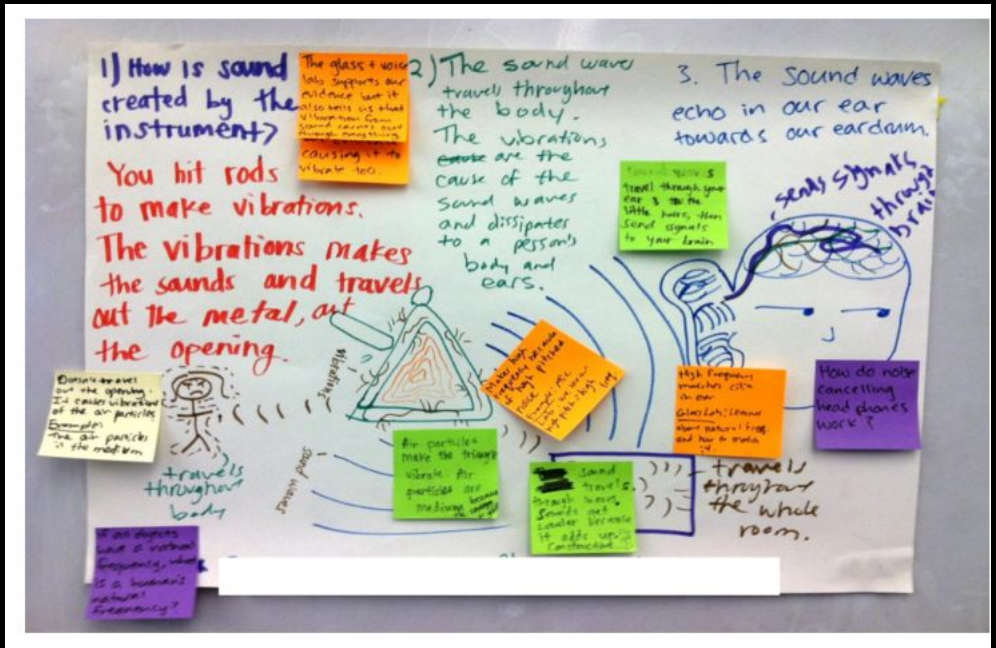
THREE DIMENSIONAL LEARNING



- Scientific & Engineering Practices
- Crosscutting Concepts
- Core Ideas

Practices are the behaviors that scientists engage in as they investigate and build models and theories about the natural world and the behaviors that engineers use as they design and build models and systems.

SCIENTIFIC & ENGINEERING PRACTICES



6th grade model explaining the transition of sound.

- Asking Questions (for science) & Defining Problems (for engineering)
- Developing & Using Models
- Planning and Carrying Out Investigations
- Analyzing & Interpreting Data Using Mathematics and Computational Thinking
- Constructing Explanations (for science) and Designing Solutions (for engineering)
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

Crosscutting concepts are concepts that have application across all disciplines of science. As such, they provide a way of linking the different disciplines of science.

Making connections to the BIG idea.

CROSSCUTTING CONCEPTS

Crosscutting Concepts

1. Patterns
2. Cause & Effect
3. Scale, Proportion & Quantity
4. Systems & System Models
5. Energy & Matter
6. Structure & Function
7. Stability & Change

Thinking, speaking, and writing like scientists and engineers.

Based on the pattern that I see I conclude…

One way key parts of this system work together is…

DISCIPLINARY CORE IDEAS

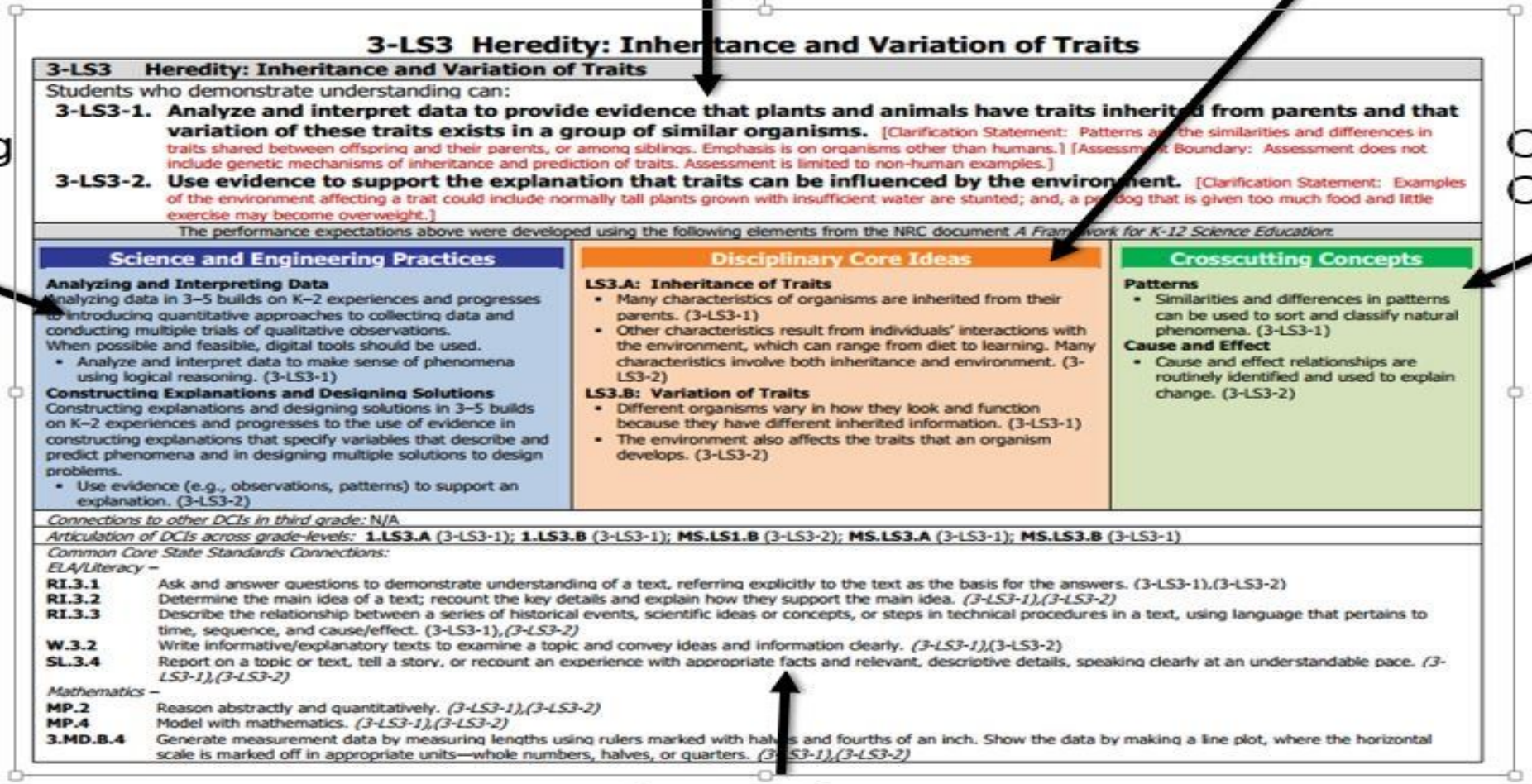
Disciplinary core ideas are the big ideas of science that provide scientists and engineers with the concepts and foundations to make sense of phenomena or design solutions to problems.

Performance Expectations

Disciplinary Core Ideas

Science & Engineering Practices

Crosscutting Concepts



3-LS3 Heredity: Inheritance and Variation of Traits

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Students who demonstrate understanding can:

3-LS3-1. **Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]

3-LS3-2. **Use evidence to support the explanation that traits can be influenced by the environment.** [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a puppy dog that is given too much food and little exercise may become overweight.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data
Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations.
When possible and feasible, digital tools should be used.
- Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2)

Disciplinary Core Ideas

LS3.A: Inheritance of Traits
- Many characteristics of organisms are inherited from their parents. (3-LS3-1)
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2)

LS3.B: Variation of Traits
- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
- The environment also affects the traits that an organism develops. (3-LS3-2)

Crosscutting Concepts

Patterns
- Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1)

Cause and Effect
- Cause and effect relationships are routinely identified and used to explain change. (3-LS3-2)

Connections to other DCIs in third grade: N/A

Articulation of DCIs across grade-levels: **1.LS3.A** (3-LS3-1); **1.LS3.B** (3-LS3-1); **MS.LS1.B** (3-LS3-2); **MS.LS3.A** (3-LS3-1); **MS.LS3.B** (3-LS3-1)

Common Core State Standards Connections:

ELA/Literacy –

RI.3.1	Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS3-1),(3-LS3-2)
RI.3.2	Determine the main idea of a text; recount the key details and explain how they support the main idea. *(3-LS3-1),(3-LS3-2)*
RI.3.3	Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1),*(3-LS3-2)*
W.3.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly. *(3-LS3-1)*,(3-LS3-2)
SL.3.4	Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. *(3-LS3-1),(3-LS3-2)*

Mathematics –

MP.2	Reason abstractly and quantitatively. *(3-LS3-1),(3-LS3-2)*
MP.4	Model with mathematics. *(3-LS3-1),(3-LS3-2)*
3.MD.B.4	Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. *(3-LS3-1),(3-LS3-2)*

Connections to other standards

IN THE CLASSROOM

Shift from

Teacher ‘telling students’
or
Students ‘learning about’

Students making sense of the science

Discourse in the classroom

- Accountable Talk
- Talk moves
- Turn and Talk

Helps students make sense of the science.

IN THE CLASSROOM

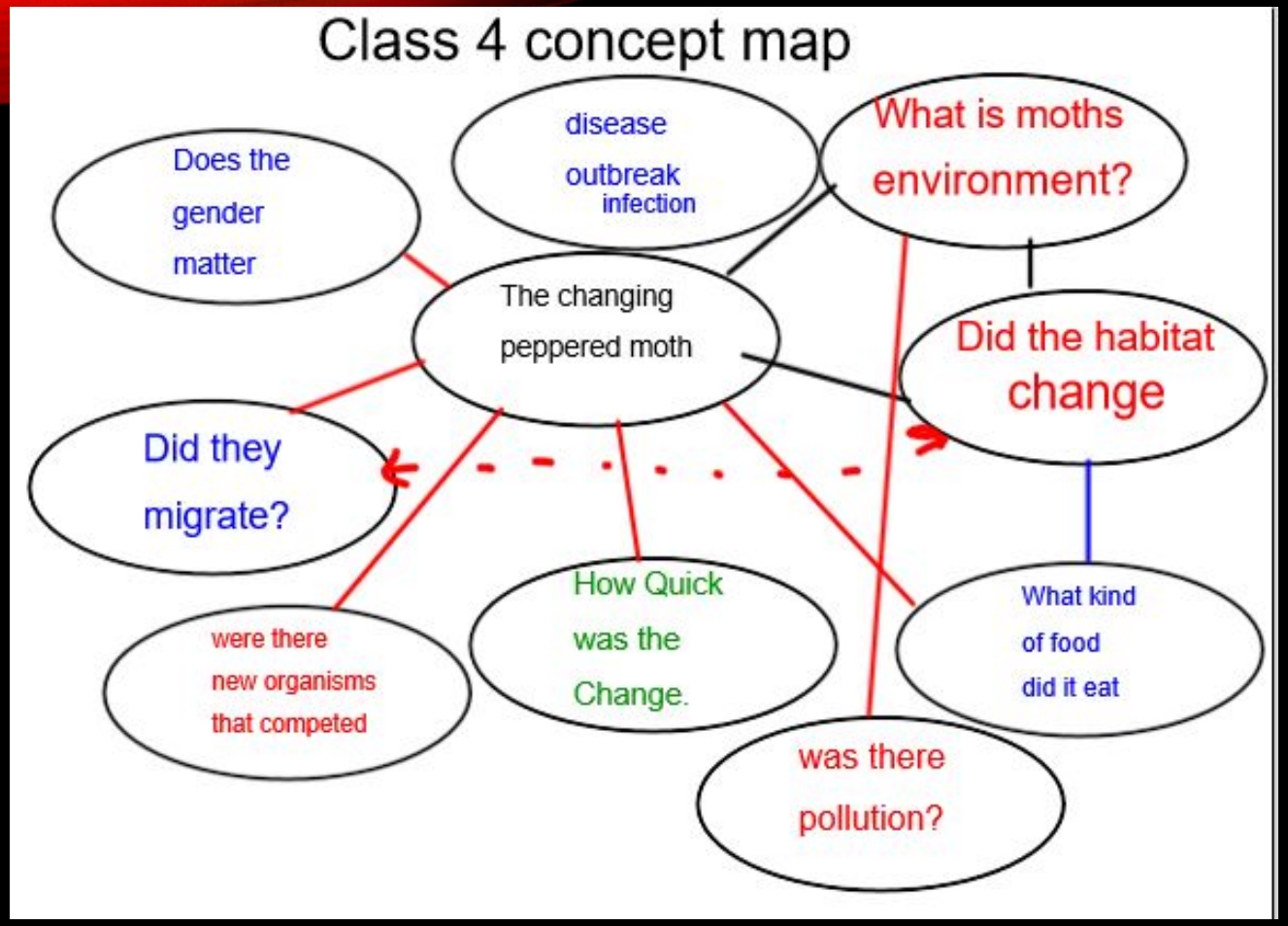
A unit's instruction begins with an observable phenomena that needs explanation.

For example:

- Why are there fossils on the top of Mount Everest?
- Why did peppered moths in England turn from white and black speckles to mostly gray by 1900 ?
- Why does a slug 'melt' when it meets salt?

Why did the moths change from speckled to gray?

Asking questions



Students explain what they think they understand about the question by building models and asking questions.

IN THE CLASSROOM

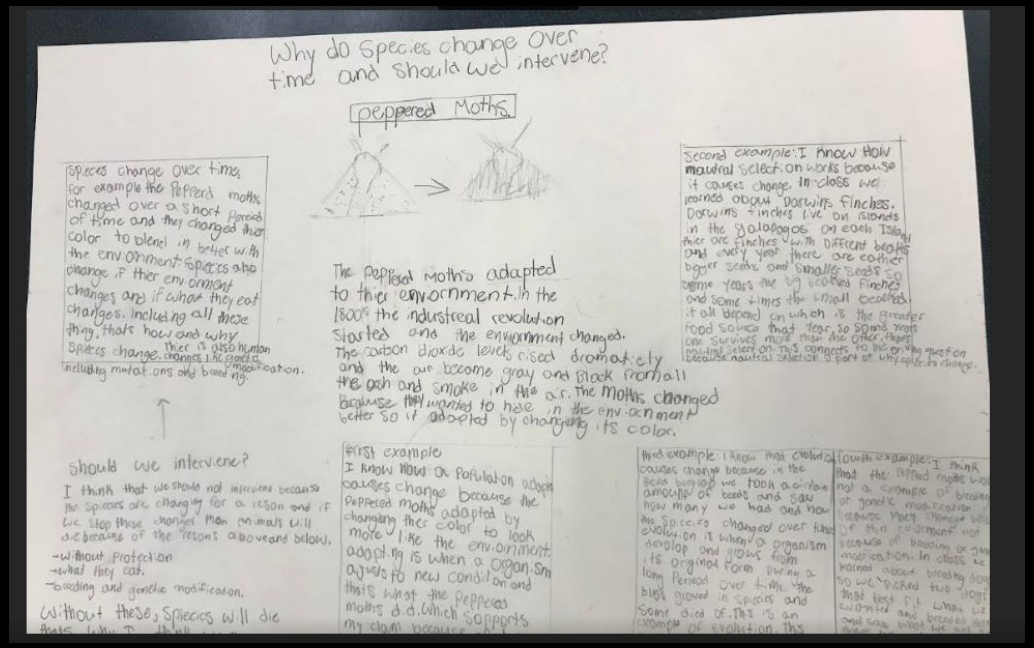
Student understanding guides the course of investigations.

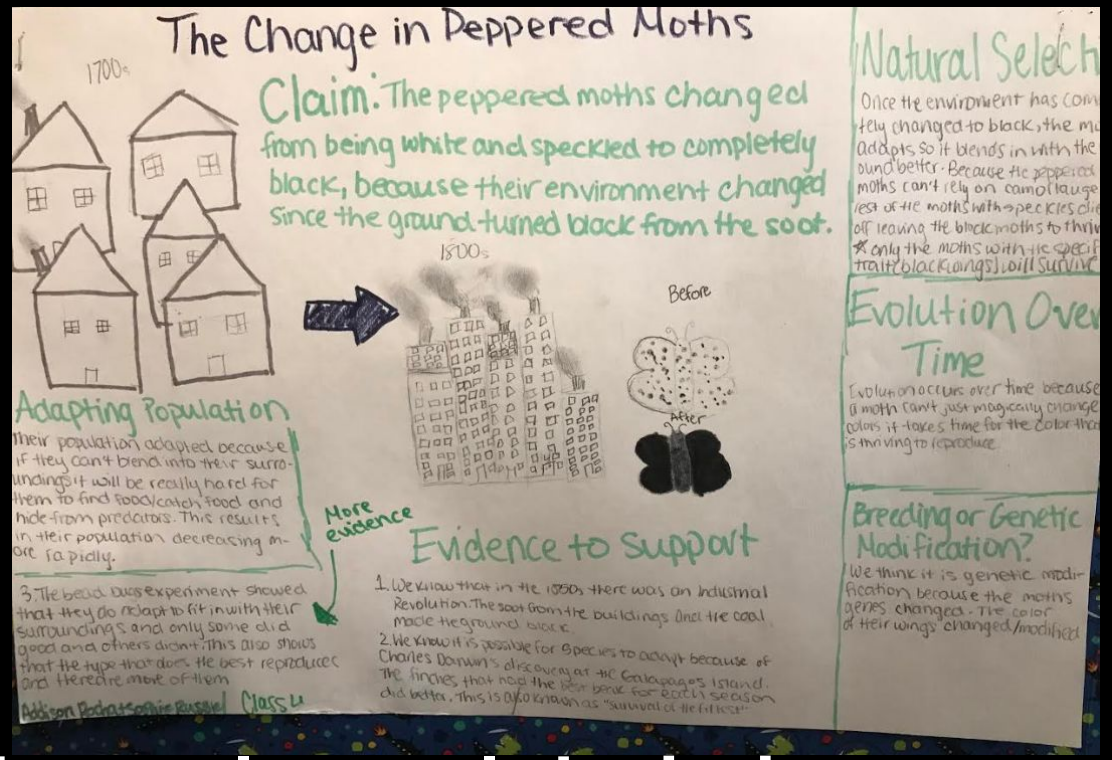
Each investigation, reading, image or video clip helps to build the bigger picture.

“What does this new information tell us about the phenomenon?”

In this process

- Revisit their initial models
- Make claims justifying with evidence & reasoning
- Dialogue allows the class to build understanding of the science concept.





Students are encouraged to explore related phenomena to broadly apply their new learning.

NGSS ASSESSMENT

In 2016, Scottsdale, Arizona, received one-third of its annual rainfall during the summer. Tucson, Arizona, received one-half of its annual rainfall during the same time period.

Figure 1 shows the typical annual rainfall, in inches, for different areas in the state.

Figure 1. Typical Arizona Rainfall

1

GUEST

Part A

Use Figure 1 to rank the Central, Southeast and Southwest Arizona regions by the typical annual rainfall.

	Most Rainfall	Second Most Rainfall	Least Rainfall
Central	☐	☐	☐
Southeast	☐	☐	☐
Southwest	☐	☐	☐

Part B

Use Figure 2 to identify the time of the year during which each city receives the most rain. Select the boxes to choose the **best** answer for each city.

NGSS

GUEST

art A

A layer of clay separates two layers of sedimentary rock in Montana. Fossils of different mammal teeth are found in both of the sedimentary rock layers.

Figure 1 shows the locations of the sedimentary rock layers and the clay layer in between.

Figure 1. Clay and Rock Layers in Montana

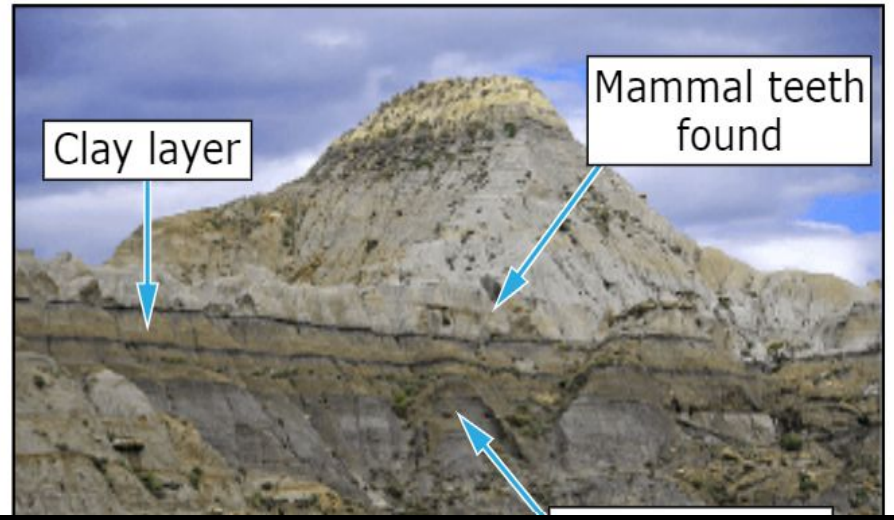
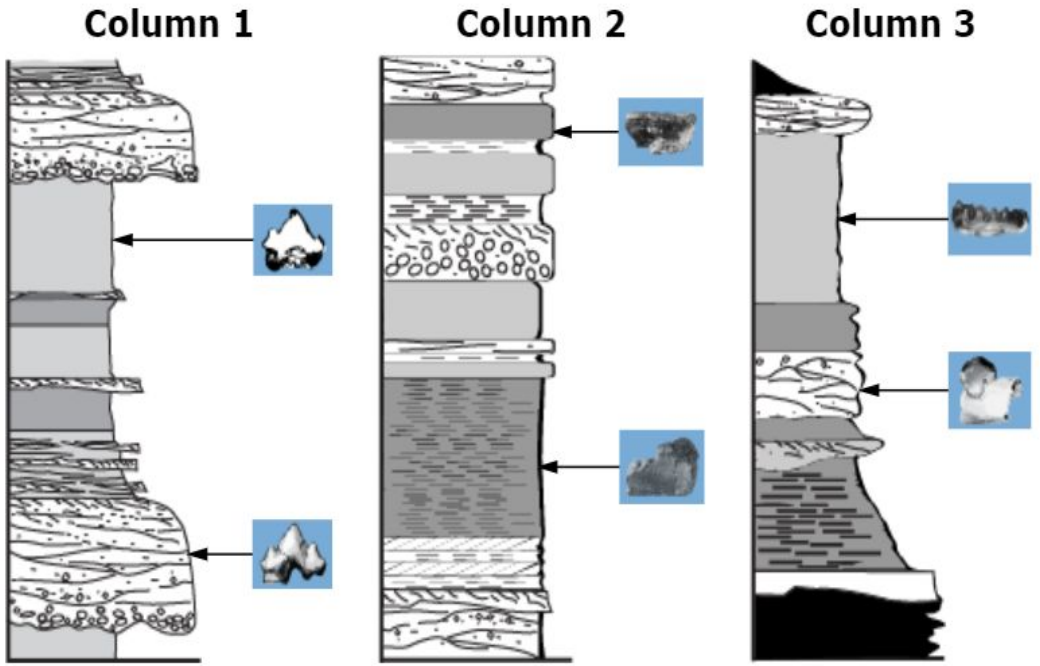


Figure 3 shows three geologic columns. These geologic columns represent the time periods from which some of the teeth in Table 1 have been recovered. The age at the bottom of each column represents the oldest known age for the teeth in that column.

Figure 3. Locations of Fossil Mammal Teeth



History of the Earth: Earth and Space Science

2019 NGSS Assessment Results

	At /Above Goal
Grade 8	80.7%
Grade 5	79.2%

NGSS Standards

- Value performance over memorization
- Designed with a multilayered approach
- Engineering and design practices are woven throughout
- Possess direct CCSS links (Reading & Math)
- Assessments are multifaceted & dynamic